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Dear Colleagues,

As described in IGS Mails #2320 (24 Jun 1999) and #2744 (15 Mar 2000), the
broadcast GPS pseudoranges possess significant satellite-dependent biases.
In particular, the C1 [=C/A] and P1 pseudoranges can differ by +- 1 ns
(30 cm). Due to differences in the internal tracking methods used, the
response to these satellite-dependent biases varies among receiver types.
Previously, the IGS has recognized two classes of receivers:

* cross-correlators -- These observe and report C1 and P2' [=C1 + (P2-P1)]
  pseudorange observables. Receivers of this type used in the IGS network
  include ROGUE SNR-x, AOA ICS-4000Z, TRIMBLE 4000, and TRIMBLE 4700.

* Y-codeless, non-cross-correlators -- These usually observe and report
  P1 and P2 pseudorange observables. Examples include ASHTECH Z-XII3,
  AOA SNR-12 ACT, and AOA BENCHMARK ACT.

It is now apparent that a third receiver class must be recognized:

* C1, Y-codeless, non-cross-correlators -- These apparently function like
  other modern Y-codeless receivers but they report C1 instead of P1, as
  well as P2 pseudorange observables. Known receivers of this type are
  TRIMBLE 5700, LEICA CRS1000, and LEICA SR9600. I do not know why the
  C1 observable is preferred over P1, although it could be due to the
  higher C1 signal strength (despite the 10 times greater bandwidth of the
  P1 modulation).

The cc2noncc utility previously handled only cross-correlator receivers by
transforming C1 and P2' observables
   C1 --> C1 + f(i)   [becomes compatible with modern P1]
   P2' --> P2'+ f(i)   [becomes compatible with modern P2]
where f(i) are empirically-determined long-term average bias values
i for satellites PRNi. In this way, overall consistency can be
achieved for a network of mixed receiver types.

Now cc2noncc has been modified to also handle C1, Y-codeless receivers by
transforming only C1 observables
   C1 --> C1 + f(i)   [becomes compatible with modern P1]

leaving the P2 pseudoranges unchanged. (The operation of Trimble receivers depends on the anti-spoofing state; it is assumed here that A/S is always on.)

As noted previously, cc2noncc will create an output file only when an input RINEX file indicates that the receiver is one of the types to be modified, so it is vital that the RINEX headers be reliable and that the IGS standard names are used .
This converter should only be applied to create intermediate files for analysis purposes and should never be used for general distribution of RINEX files!

The Fortran code for cc2noncc (version 3.0, 29 Jan 2002) is available at
. The bias values
remain unchanged from those announced in IGS Mail #3674 (08 Jan 2002).

At the present time, the IGS tracking stations affected by this change are:
NOUM (TRIMBLE 5700), BZRG (LEICA CRS1000), MALD (LEICA CRS1000), TGCV (LEICA CRS1000), and UCLU (LEICA CRS1000). There are no LEICA SR9600 receivers in current use.

My thanks to Stefan Schaer for pointing out this new class of receivers and for analyzing their behavior, to Lou Estey for valuable advice, and to Angie Moore for her diligence in working with the receiver manufacturers.